Exhibit A

Zigler Declaration 1/19/24

UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

IN RE: CHRYSLER PACIFICA FIRE RECALL PRODUCTS LIABILITY LITIGATION MDL No. 3040 *This Document Relates to: ALL ACTIONS*	Case No. 22-md-03040 Honorable David M Lawson Magistrate Judge Elizabeth S Stafford

DECLARATION OF DR. BRADLEY ZIGLER

January 19, 2024

Table of Contents

List of Figures

1 Introductions and Qualifications

I, Bradley Thomas Zigler, am a Senior Director at 44 Energy Technologies Incorporated ("44 Energy"), a consulting firm located at 4055 Linden Street, Oakland, California. 44 Energy provides technical consulting services and expert testimony throughout the United States, Canada, United Kingdom, Australia, and other countries. 44 Energy has extensive experience assessing manufacturing and design defects in automobiles. I hold a Doctor of Philosophy (Ph.D.) in Mechanical Engineering from the University of Michigan, Ann Arbor, Michigan; a Master of Science (M.S.) in Mechanical Engineering from Wayne State University, Detroit, Michigan; a Master of Engineering Management from the University of Detroit-Mercy, Detroit, Michigan; and a Bachelor of Science (B.S.) in Mechanical Engineering from the Milwaukee School of Engineering, Milwaukee, Wisconsin. As a Senior Director at 44 Energy, I am currently consulting as an expert for legal matters related to automotive systems engineering with internal combustion engines. In my capacity at 44 Energy, I serve as a principal consultant, and I also manage a team of consulting engineers to assist with my review and analysis.

44 Energy was founded in in 2013. Over the past eleven years, our company has worked on a large number of consulting projects, primarily in the area of engine powertrain, including hybrid-drive systems, emissions, and emission control technology. Our company has expertise in the areas of technology development, engine emissions and performance testing, advanced powertrain technologies including electric and hybrid-drive systems, and regulatory compliance. As a Senior Director and a principal consultant, I rely on an in-depth understanding of advanced powertrain systems, diesel and gasoline engines, emissions, state of the art emission control technologies, and regulatory requirements. I have been a Senior Director at 44 Energy since December 2021.

Prior to my tenure at 44 Energy, I served as a Principal Engineer leading the Fuels and Combustion Science research group at the National Renewable Energy Laboratory, a U.S. Department of Energy research laboratory. I was also formerly a product design engineer at Ford Motor Company for over a decade, responsible for engine systems engineering and advanced transmission engineering. While at Ford, I was trained in original equipment manufacturer (OEM) methodologies for product development and quality, including Failure Mode Effects Analysis (FMEA), Design Verification Plan and Report (DVP&R), Six-Sigma, and ISO 9001 quality management system certification.

Additionally, I have published peer-reviewed papers with the Society of Automotive Engineers (SAE) and the American Society of Mechanical Engineers (ASME). I was elected an ASME Fellow in 2022, a prestigious honor that recognizes outstanding achievements in mechanical engineering.

My company, 44 Energy, is being compensated $500 per hour for my services on an hourly basis, and my compensation is not dependent on the outcome of this case or the substance of my opinions. A list of my publications is contained in my attached curriculum vitae (5.6APPENDIX A:). I have not previously testified as an expert witness at trial or by deposition.

2 Purpose of This Report

Counsel for the plaintiffs have asked me review available information about the 2017-2018 model year (MY) Chrysler Pacifica Plug-In Hybrid Electric (PHEV) vehicles ("Class Vehicles") related to possible defects related to the high-voltage (HV) battery pack and vehicle system resulting in fires. My review includes information available to date regarding the battery, battery management system, and vehicle system engineering from a development process, vehicle manufacturing process, and quality system feedback perspective. My review also includes information available at this time regarding Fiat Chrysler Automobiles (FCA) recall of the Class Vehicles for fires related to the HV battery pack, including the effectiveness of the recall fix.

3 Facts and Data Considered in Forming My Opinions

In conducting my analysis, I, along with 44 Energy staff working under my direction, have reviewed, and analyzed documents provided to me in the course of this litigation, including confidential documents and data produced by the parties, as well as publicly available information. A list of the materials I have reviewed and relied upon in preparing my opinions is shown in the Appendices and footnotes, where applicable. My review and this report are based on information provided to me to date, including discovery documents provided to the plaintiffs by FCA. I understand that FCA has not completed its production of documents responsive to plaintiffs' discovery requests. Should I receive new or additional information relevant to my opinions expressed below, I may supplement this report.

4 Vehicle Class Overview

The MY 2017-2018 Chrysler Pacifica Hybrid minivans are PHEV vehicles on FCA's "RU" vehicle platform incorporating a 3.6L V6 gasoline engine in a front-wheel drive (FWD) hybrid powertrain configuration with dual-electric motors integrated with an electrically variable transmission.[1,2] The MY 2017-2018 Chrysler Pacifica Hybrid powertrain uses a 16 kWh, Lithium-ion (Li-ion) HV battery pack supplied by LG Chem Michigan Inc.[3] The HV battery pack is comprised of 96 LG Chem A7 pouch-type Li-ion polymer cells using indirect liquid cooling.[3] The HV battery pack is capable of being charged with either 120 volt (V) alternating current (AC), 15 amp (A) SAE J1772 Level 1 Electric Vehicle Supply Equipment (EVSE) or 240 V AC, 30 A EVSE.[4] While the MY 2017-2018 Chrysler Pacifica Hybrid was available in various trim levels (Touring Hybrid and Limited Hybrid), each used the same hybrid powertrain and common Li-ion HV battery pack. Based on FCA's Z11 safety recall notice, the entire population of MY 2017-2018 Chrysler Pacifica Hybrid vehicles comprise the Class Vehicles.[5]

[1] https://en.wikipedia.org/wiki/Fiat_Compact_platform
[2] https://www.stellantisfleet.com/content/dam/fca-fleet/na/fleet/en_us/chrysler/2017/pacifica/vlp/docs/Pacifica_Specifications.pdf
[3] EN50-0367_Rev2_FCA RU MY17 Product Manual (customer copy).pdf
[4] 2017 Chrysler Pacifica Hybrid Owner's Manual, 4275.pdf, https://www.mopar.com/chrysler/en-us/my-vehicle/owners-manual.html?openGarage=true
[5] https://static.nhtsa.gov/odi/rcl/2022/RCLRPT-22V077-7442.PDF

5 Opinion

5.1 Systems Engineering Background

In reviewing the MY 2017-2018 Chrysler Pacifica Hybrid fires related to the HV battery pack, it is helpful to consider the HV battery pack in relation to FCA's vehicle system engineering for the Chrysler Pacifica Hybrid. Modern vehicle development programs commonly follow a systems engineering development process according to a V-model, illustrated in Figure 1.

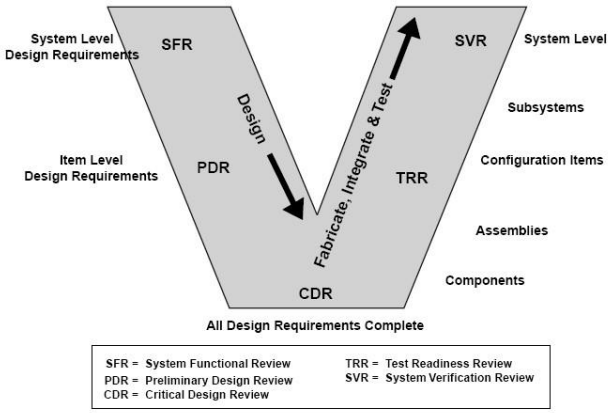

Figure 1. Illustration of a V-model for systems engineering.[6]

Vehicle level design requirements (i.e., vehicle manufacturing cost, vehicle performance, vehicle seating capacity) are cascaded down to system level design requirements (i.e., hybrid powertrain output capacity), which are in-turn cascaded down the "V" to component level design requirements (i.e., HV battery storage capacity). Design review stages cascade and document these requirements. Component level designs lead to subsystem and system level designs back up to the overall vehicle design. Testing is completed going back up the "V" to validate that the designs satisfy component level through subsystem level through system level requirements. Well-established engineering process tools are commonly used in the automotive industry as part of this design development process, including:

- Failure Mode and Effects Analysis (FMEA) at the component and system levels to preventatively identify and address potential failures and their resulting effects on the higher-level system
- Design Validation Plan and Report (DVP&R) to design the validation test plan based on the component and system level FMEAs, as well as documenting the results

This systems engineering perspective is helpful in considering further discussion of the HV battery pack as a critical component of the Pacifica Hybrid powertrain system.

5.2 The HV Battery Pack is Common To All the Class Vehicles

The MY 2017-2018 Chrysler Pacifica Hybrids share a common hybrid powertrain system design, using the same HV battery pack design, supplied by LG Chem (now part of LG Energy Systems).[7] The HV battery pack is identified as part number 5 in the service parts diagram for a MY 2017 Chrysler Pacifica Hybrid in Figure 2.[8] The same service part number (68488189AA) for the HV battery pack now appears

[6] https://en.wikipedia.org/wiki/V-model#cite_note-18
[7] EN50-0367_Rev2_FCA RU MY17 Product Manual (customer copy).pdf
[8] https://store.mopar.com/oem-parts/mopar-mild-hybrid-motor-generator-unit-mgu-battery-pack-68488189aa

to be common for MY 2017 through current MY 2024 Chrysler Pacifica Hybrid vehicles, indicating it is a common design and interchangeable part (Figure 3). FCA previously supplied the U.S. National Highway Traffic Safety Administration (NHTSA) with a list of 25 specific battery part numbers for MY 2017 and MY 2018 Chrysler Pacifica Hybrid vehicles, stating they were all "involved" in the issue.[9] The information available from discovery to date and FCA's reports to NHTSA, including information associated with its Z11 recall, confirm that all MY 2017-2018 Chrysler Pacifica Hybrid vehicles were delivered with battery packs that have the potential for spontaneous fire, as described and admitted by FCA in FCA's Z11 recall documentation. Importantly, whether the battery packs in the Class Vehicles indeed have a defect, as FCA has indicated in its recall, is a question that will be answered on a class wide basis using evidence common and applicable to the entire class.

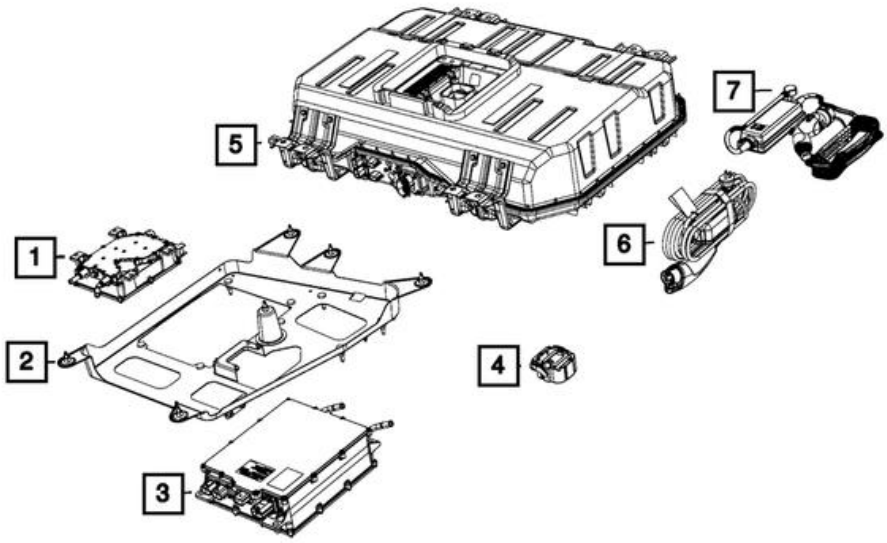

Figure 2. MY 2017 Chrysler Pacific Hybrid HV battery pack and related components.[8]

[9] https://static.nhtsa.gov/odi/rcl/2022/RMISC-22V077-7295.pdf

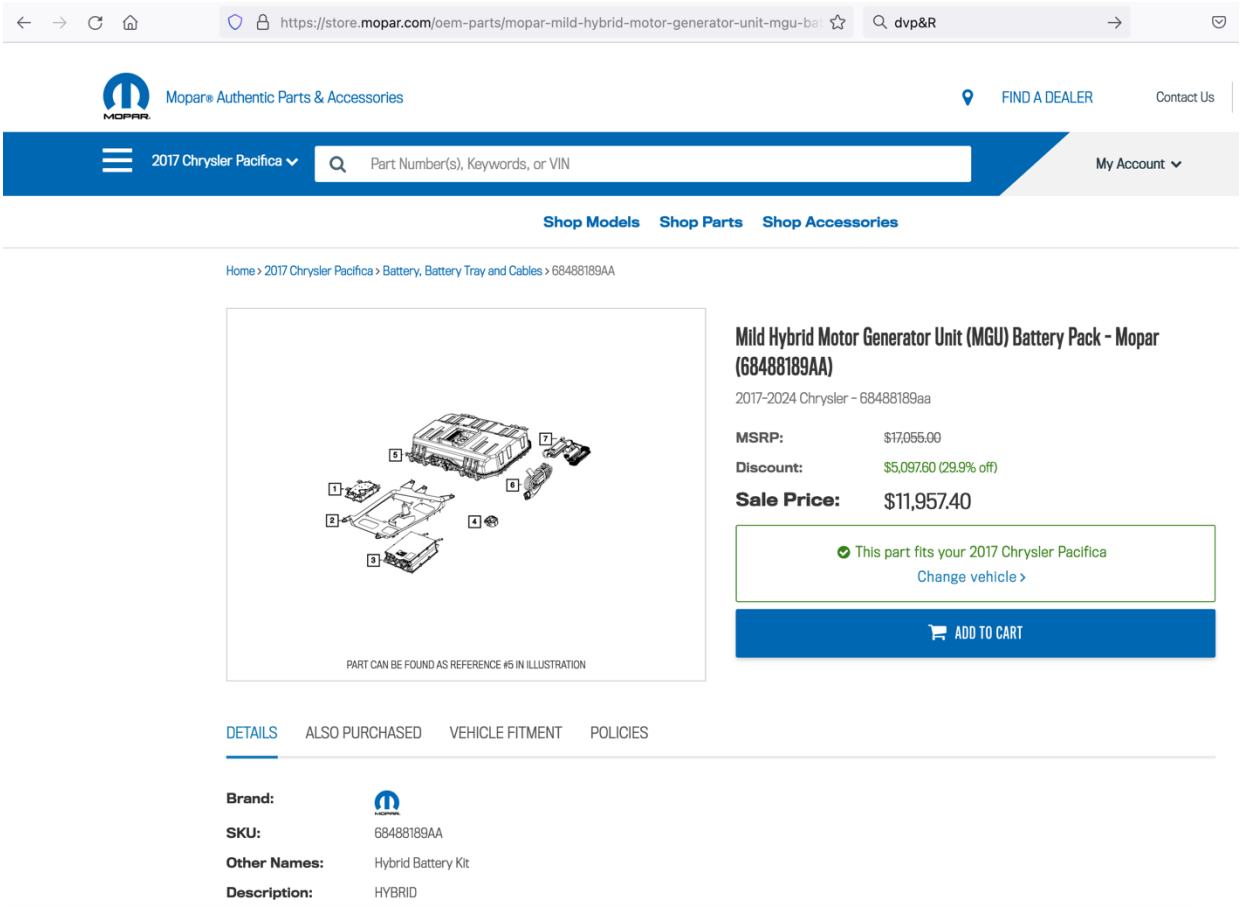

Figure 3. Online Chrysler dealer part record for MY 2017 Chrysler Pacifica Hybrid HV battery[8]

5.3 FCA Safety Recall Report for MY 2017-2018 Chrysler Pacifica Hybrid Vehicles Covers All Class Vehicles.

In a February 11, 2022 vehicle safety recall report to NHTSA, FCA reported a safety recall for all MY 2017-2018 Chrysler Pacifica Hybrid vehicles related to fires, for which the defect had not been identified and root cause not been determined at that time.[10] That recall was identified as NHTSA recall number 22V-077 and manufacturer recall number Z11.[10] In that recall notice, FCA stated:
"The potentially affected vehicle production period began on August 12, 2016, when production of Chrysler Pacifica PHEVs began, and ended on August 7, 2018, when 2018 MY production ended. The suspect population was determined using vehicle manufacturing records. Similar vehicles not included in this recall are not PHEVs, or were built after the suspect vehicle production period."[10]

The safety recall report additionally reported that FCA was aware at that time of 12 vehicle fires in MY 2017-2018 Chrysler Pacifica Hybrid vehicles and that *"a vehicle may experience a fire, even with the ignition in the "OFF" mode."*[10]

[10] https://static.nhtsa.gov/odi/rcl/2022/RCLRPT-22V077-3486.PDF

5.4 FCA's Analysis of HV Battery Pack Manufacturing Defects Prompted the Recall of All Class Vehicles.

Documents produced in discovery to date chronicle FCA's internal investigation and reporting to the FCA Vehicle Regulations Committee about the Chrysler Pacifica Hybrid fires, initially covering MY 2017 through 2022 (then current MY).[11,12] The potential failure mode was identified as vehicle fire originating from the HV battery, where a *"defect within the HV battery may result in a fire"* and that a *"HV battery that fails internally may result in a vehicle fire, even with the ignition in the 'OFF' mode"*.[11,12]

FCA analysis for the 12 known reported fires immediately prior to notifying NHTSA about the Z11 safety recall indicated that all occurred within MY 2017-2018 vehicle production periods (Figure 4).[12]

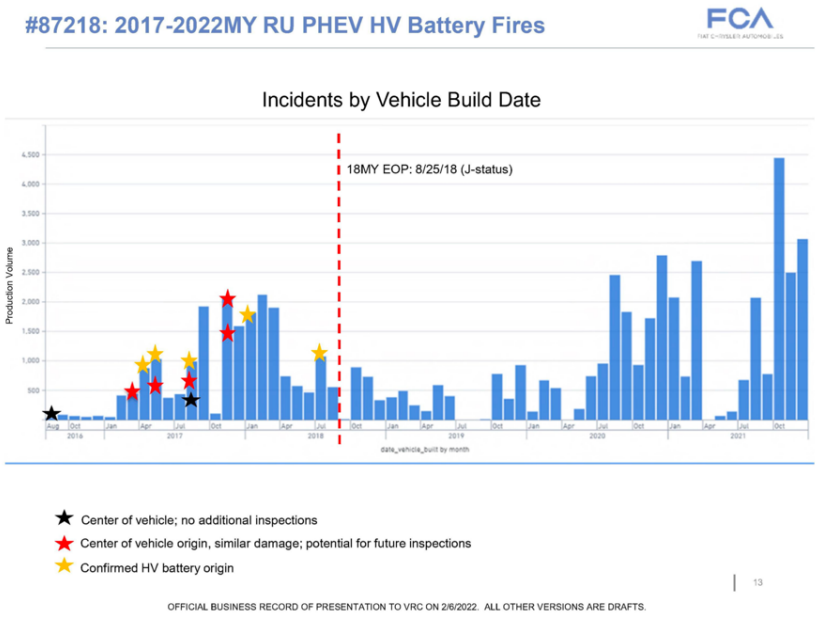

Figure 4. FCA Analysis of HV Battery Fires by Vehicle Build Date[12]

Since FCA has determined that the risk of battery fires occurs only in the batteries manufactured for the 2017 and 2018 model year Pacifica Hybrids, and since the batteries for the 2019-present model year Pacifica Hybrid have the same service part and are thus backward compatible, one remedy available to FCA would be to replace the HV battery in Class Vehicles with batteries manufactured for the 2019 and later model year Pacifica Hybrids.

5.5 FCA's Engineering Documents Apply to All Class Vehicles and Will Provide Common Evidence of Whether the Class Vehicles Were Adequately Tested Prior to Their Release For Sale.

Discovery, which is still ongoing, should include FCA's FMEAs for the hybrid powertrain system, lower level subsystems (such as the battery management system controls), HV battery pack, and battery cells. Such analysis would be expected to include FMEAs with Risk Priority Number (RPN) calculations. Standard industry practice for RPN calculations include the following:[13]

[11] FCA_Pacifica_MDL-009320.pdf (1/26/2022)
[12] FCA_Pacifica_MDL-009297.pdf (2/6/2022)
[13] https://www.isixsigma.com/dictionary/risk-priority-number-rpn/

- Severity (S) – the impact of the failure mode being present, ranked 1 to 10 with 10 being highest severity and typically hazardous without warning, with the potential for significant harm;
- Occurrence (O) – the probability of the failure mode being present, ranked 1 to 10 with 10 being the highest occurrence and typically defined as almost inevitable;
- Detection (D) – the ease or capability of failure mode detection and escape prevention, ranked 1 to 10 with 10 being the highest uncertainty of detection.

The RPN is then calculated as the produce of R * O * N. The FMEA and RPN calculation is customarily used to create the DVP&R as part of the "upward leg" of the V-model to validate components, subsystems, and systems.

A proper FMEA is a critical matter in the design and production of a safe vehicle. Whether a proper FMEA was conducted for the Class Vehicles is an issue common to all class members. In my merits report I will opine on whether a proper FMEA was conducted. The FMEAs will provide common and class wide evidence of whether the Class Vehicles were adequately tested prior to their release for sale. This evidence is common and class wide because the Hybrid Drive system in the Pacifica was the same across all trims for the 2017 and 2018 model years.

5.6 The Effectiveness of FCA's Z11 Recall Will Be Determined on a Class Wide Basis Using Evidence Common to All Class Vehicles.

FCA's safety recall Z11 repair actions for Class Vehicles did not include replacement of the HV battery pack. Instead, the latest version (Revision 4, November 2022) of FCA's Dealership Service Instructions for safety recall Z11 involves a Battery Pack Control Module (BPCM) software update procedure.[14]

The Dealership Service Instructions specify the same process to be applied to all Class Vehicles and the same software update to be installed in the BPCM for all Class Vehicles. Analysis of this software update will therefore necessarily provide evidence on a class wide basis as to whether the software update provides an effective fix that will prevent further spontaneous fires in Class Vehicles. In addition, since all the Class Vehicles are getting the same software update to the same hybrid drive system, whether the Class Vehicles continue to suffer spontaneous fires will be common evidence of the effectiveness of the Z11 Recall remedy.

In my merits report, I will determine whether the risk of battery cell failures in MY 2019 – current production lots of batteries are sufficiently low to be "clean" for these fire events. Assuming that FCA has correctly determined this to be the case (as reflected by its limitation of the recall to only 2017 and 2018 model year Pacifica Hybrids), then replacement with newly produced batteries is one available repair to alleviate the fire risk. In sum, one way to ensure that the fire risk is competently and adequately addressed is to replace the batteries in the 2017-2018 Chrysler Pacifica Hybrids with later-produced batteries that FCA asserts do not contain the defect that is the subject of the Z11 recall.

January 19, 2024

Bradley T. Zigler, Ph.D

[14] https://static.nhtsa.gov/odi/rcl/2022/RCRIT-22V077-5391.pdf

APPENDIX A: Bradley T. Zigler, Ph.D. - Curriculum Vitae

PROFESSIONAL EXPERIENCE

44 Energy Technologies, Oakland, California
Senior Director, 2021 - present

Responsible for development and growth of engineering and technical services in mobility, energy, and powertrain practice areas. Ensure quality of deliverables and client engagement, while leading highly skilled technical engineering team. Apply deep product design and internal combustion engine research background to technical projects, case management, and expert testifier roles.

44 Energy Technologies is a privately held corporation, providing consulting services to assist in all aspects of development and commercialization of energy, transportation, and environmental technologies. 44 Energy Technologies also provides expert witness services in the automotive industry. The 44 team has extensive experience with fuels, engines, emissions, and advanced powertrain technologies. In addition, 44 understands the role of government policy, regulation, and legislation as a driving force to create market opportunities for new products and technologies. To that end, 44 effectively advises clients on program development and implementation to capitalize on these opportunities.

The company provides consulting and contracting services including opportunity identification, grant and proposal writing, program management, building teams of contractors and experts, testing, and engineering analysis.

National Renewable Energy Laboratory, Golden, Colorado
Principal Engineer and Acting Group Manager, 2008 - 2021

Technical task leader and acting group manager for the Fuels and Combustion Science research group within the Center for Integrated Mobility Systems, primarily funded by the U.S. Department of Energy (DOE), Vehicle Technologies Office. Research focused on the intersection of fuel physicochemical properties, ignition kinetics, combustion, and emissions to support the simultaneous development of renewable, low-carbon fuel chemistries and high-efficiency, low-emissions advanced combustion engines.

Lead research to determine impacts of fuel properties on the efficiency, performance, and emissions of advanced internal combustion engines with experiments and simulations spanning fundamental, bench-scale studies of fuel ignition chemistry, single-cylinder research engines, and applied research on vehicle emissions. Responsible for managing DOE-funded research portfolio; developing external client-funded projects; growing experimental and simulation research capabilities; collaborating with industry, academia, and other DOE labs; and recently managing a group of 22 scientists, engineers, postdocs, graduate students, and faculty joint appointments.

Involved in early-stage planning and subsequent execution of large DOE multi-lab research initiatives including co-optimization of low carbon fuels and high efficiency engines (Co-Optima) and a high efficiency natural gas engine collaboration. Managed NREL coordination for incoming funding from DOE, California Energy Commission, and South Coast Air Quality Management District and related outgoing NREL-awarded subcontract projects for natural gas engine development.

University of Michigan, Ann Arbor, Michigan
Graduate Student Research Assistant, 2002 - 2008

Conducted experimental dissertation research under Prof. Margaret S. Wooldridge (Mechanical Engineering), including building an optically accessible single cylinder research engine facility. Assisted Wooldridge research group peers in the Combustion and Environmental Research Laboratory, including extensive fuel ignition kinetics research using a rapid compression facility. Mentored undergraduate students and conducted manufacturing facility energy efficiency studies under a DOE-funded Industrial Assessment Center. Taught undergraduate and graduate students in Automotive Systems Engineering as a graduate student teaching assistant.

Ford Motor Company, Dearborn, Michigan
Product Design Engineer, 1992 - 2002

Progressed initially from Ford's College Graduate Program (FCGP) with various product design engineering rotations within Powertrain Operations to become a product engineer with design and release responsibility in Transmission and Chassis Division, and Engine Engineering.

Engine systems design responsibility for inline 4-cylinder engines (2.0L Zetec 16V and 2.0L Split-Port-Induction 8V) used in North American vehicle applications, including Escort, Focus, and Escape. Lead engine systems design of Ultra-Low Emissions Vehicle (ULEV) application of 2.0L SPI engine for MY2001 Ford Focus, Ford's first ULEV program in North America.

Advanced Transmission / Pre-Program Engineering system design and powertrain matching (gear ratios and torque converter specifications) for the 5U60/5U45 automatic transaxles, Ford's first prototype 5-speed front-wheel drive automatic transaxle. Mechanical system design for rear-wheel-drive automatic transmissions, including significant mechanical upgrades to the E4OD (electronically controlled 4-speed) used in heavy-duty versions of F-Series trucks.

Trained in Ford methods for Failure Mode and Effects Analysis (FEMA), Design Validation Plan and Report (DVP&R), Geometric Dimensioning and Tolerancing (GD&T), Six Sigma, and ISO 9001 quality management system certification.

Education

Ph.D., Mechanical Engineering, University of Michigan, 2008
Emphasis in advanced engine combustion strategies and fuel ignition kinetics
Thesis title: An experimental investigation of the ignition properties of low temperature combustion in an optical engine
Advisor: Prof. Margaret S. Wooldridge
Honors: Corlett Fellowship, 2002 - 2003

M.S., Mechanical Engineering, Wayne State University, 2001

M., Engineering Management, University of Detroit-Mercy, 1996

B.S., Mechanical Engineering, Milwaukee School of Engineering, 1992

Journal Publications

Thornburg, N.E., Feng, X., Zigler, B.T., Day, M.S., Yellapantula, S., Narumanchi, S. “Model assessment of synthetic jets for turbulent combustion experiments”, Flow Turbulence Combust (2023). https://doi.org/10.1007/s10494-023-00410-9. (2023).

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PROFESSIONAL SERVICE

ASME Internal Combustion Engine Division (ICED)

- Nominations Committee Chair, 2019-Present
- Division Chair, 2016-2017
- Member of the Executive Committee, 2011-2017
- Technical Program Chair, ASME Internal Combustion Engine Division Fall Technical Conference, Dearborn, MI, October 13-16, 2013
- Chair, Advanced Combustion Technical Committee, ASME Internal Combustion Engine Division, 2010-2011
- Co-chair, Advanced Combustion Technical Committee, ASME Internal Combustion Engine Division, 2007-2010
- Member of the Board of Associates, 2007-Present

Funding opportunity reviewer

- National Science Foundation
- U.S. Department of Energy
- California Energy Commission
- South Coast Air Quality Management District

Dissertation and thesis committee service

- Eric Osecky, Ph.D. Chemical Engineering (2013), Colorado School of Mines
- Drew Cameron, M.S. Mechanical Engineering (2017), University of Colorado-Boulder

MEMBERSHIPS

ASME, Fellow – Elected 2022

ASME, Internal Combustion Engine Division

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